FORM PTO-1390 (REV 10-94) U.S. Dept. of Commerce and Patent and Trademark Office

**TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371**

ATTORNEY'S DOCKET NUMBER: **H82.2-10148**

U.S. APPLICATION NO. (If known): 09/937172

| INTERNATIONAL APPLICATION NO.: | INTERNATIONAL FILING DATE (dd/mm/yy): | PRIORITY DATE CLAIMED (dd/mm/yy): |
|---|---|---|
| **PCT/NO00/00093** | 17 March 2000* | **25 March 1999** |

TITLE OF INVENTION: A METHOD OF MANUFACTURING FEED PELLETS AND PLANT FOR USE IN THE IMPLEMENTATION OF THE METHOD

APPLICANT(S) FOR DO/EO/US:
**Odd Geir Oddsen, Harald Skjørshammer, Fred Hirth Thorsen**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.

2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.

3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).

4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States receiving Office (RO/US).

6. ☐ A translation of the International Application into English (35 U.S.C. 371 (c)(2)).

7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.

8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. ☐ An oath or declaration of the inventor (35 U.S.C. 371(c)(4)).

10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11. to 16. below concern other document(s) or information included:**

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.

12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.29 and 3.31 is included.

13. ☒ A **FIRST** preliminary amendment. Please enter the amendment before fee calculation.
    ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.

14. ☐ A substitute specification.

15. ☐ A change of power of attorney and/or address letter.

16. ☐ Other items or information:

| 17. ☐ The following fees are submitted: | CALCULATIONS | PTO USE ONLY |
|---|---|---|
| **BASIC NATIONAL FEE (37 CFR 1.492(A)(1)-(5)):** *(select the appropriate one of the following fees)*<br>Search Report has been prepared by the EPO or JPO ..... $ 930.00<br>International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... $ 490.00<br>No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... $ 750.00<br>Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... $ 1,070.00<br>International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Articles 33(2)-33(4) ..... $ 98.00<br>**ENTER APPROPRIATE BASIC FEE AMOUNT =** | $ | |
| Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)). | $ | |

| CLAIMS | NUMBER FILED | NUMBER EXTRA | RATE | | |
|---|---|---|---|---|---|
| Total Claims | - 20 = | | x $ 22.00 | $ | |
| Independent Claims | - 3 = | | x $ 82.00 | $ | |
| Multiple Dependent Claims (if applicable) | | | + $ 270.00 | $ | |
| **TOTAL OF ABOVE CALCULATIONS =** | | | | $ | |
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| **SUBTOTAL =** | | | | $ | |
| Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). | | | | $ | |
| **TOTAL NATIONAL FEE =** | | | | $ | |
| Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property | | | | $ | |
| **TOTAL FEES ENCLOSED =** | | | | $ | |
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a. ☐ A check in the amount of $___ to cover the above fees is enclosed.

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c. ☐ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 22-0350.

d. ☒ Filing fee is NOT ENCLOSED - fee will be paid at the time of responding to Notice of Missing Requirements - DO NOT CHARGE DEPOSIT ACCOUNT

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**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | |
|---|---|
| **In re Application of:** | Odd Geir Oddsen, Harald Skjørshammer, Fred Hirth Thorsen |
| **U.S. Nat'l Stage of Int'l App. No.:** | PCT/NO00/00093 |
| **Int'l Filing Date:** | 17 March 2000 |
| **For:** | A METHOD OF MANUFACTURING FEED PELLETS AND PLANT FOR USE IN THE IMPLEMENTATION OF THE METHOD |

BOX PCT
Commissioner for Patents
Washington, D.C. 20231

**Docket No.: H82.2-10148**

## PRELIMINARY AMENDMENT

Applicant submits this Preliminary Amendment within the U.S. National Stage related to International Application No. PCT/NO00/00093 as filed on March 17, 2000, having a priority date of March 25, 1999. The Preliminary Amendment herein relates to the Published Application having an International Publication Date of October 5, 2000, and International Publication Number WO 00/57718.

The claims were previously amended in response to the International Preliminary Examination Report of the 20th day of July 2000. Amended claims 1-8 are presently pending within this application. Applicant encloses herewith a photocopy of previously amended claims 1-8 for the convenience of the Patent Office.

As a Preliminary Amendment, please amend this applications as follows:

On page 1, please replace lines 1 and 2 as follows:

"A METHOD FOR MANUFACTURING FEED PELLETS AND A PLANT FOR USE IN THE IMPLEMENTATION OF THE METHOD"

On page 1, between lines 2 and 3, please insert the below identified paragraphs and/or pages:

**"BACKGROUND OF THE INVENTION**

Feed pellets for fish and animals are manufactured on an industrial scale in a multi-stage process. The porosity or specific gravity of completely formed feed pellets or product may be an important criterion for quality of several types of food and feed products, including feed pellets for reared fish. The porosity of the product is of importance to the possibility of adding liquid nutrients which are absorbed into the product; the porosity is further of importance to floating capacities in a suitable medium, and it is of importance to the texture criterions like crispness, mouth sensation and toughness. To pellets of fish feed the porosity is important with respect to the ability of the pellets to absorb oil in the production process, and for the floating capacity/buoyancy in water on feeding.

Existing methods of manufacturing are hard to control accurately, in order for the product to have the desired porosity, or sufficient porosity for the products, feed substances, and/or feed pellets to achieve a desired absorption of fat.

For some products it will be important to be able to control the production process towards a minimum of expansion in, for example pellets, whereas the opposite will be the case for other products. In producing, among other things, feeds for pets such as for example dogs and cats, and feed for reared fish, this possibility of controlling the degree of expansion/porosity is essential, because the aim is often to enable addition of as much fat/oil as possible in a subsequent processing stage for pellets to be fed to fish. For fish feed the control of its degree of expansion is particularly important because such feed should, in addition, exhibit defined sinking capabilities in water after its fat/oil absorption.

## GENERAL DESCRIPTION OF THE INVENTION

This invention relates to a method for manufacturing feed pellets, whereby moist feed pellets are subjected to negative pressure followed by a drying process, in order to achieve a more porous pellet and a lower temperature load.

The invention also relates to a plant for use in the implementation of the method, the plant generally comprising a pellet chamber, preferably interconnected downstream of a pelletizing machine, an extruding device for pellets or a similar pellet forming device.

An object of the invention is to provide a method and a plant of the initially mentioned kinds, for use in the manufacturing of porous pellets, whereby a better control of the porosity of the feed product is obtained as compared to the known techniques.

Another object is to achieve a lower temperature load on the product through the processing. Since known methods normally require an extra supply of energy, such as heat, to achieve increased expansion, the opposite effect of what was normally to be expected has been achieved by means of the invention. By the use of negative pressure also in the subsequent drying process and possibly a deep-frying process, an essentially lower temperature load can be achieved for the product as compared to conventional methods.

Also, the invention comprises a method whereby the pelletizing is carried out by a first reduced pressure, whereas the subsequent drying is implemented at a second reduced pressure.

**BRIEF DESCRIPTION OF THE DRAWING:**

Figure 1 is a schematic diagram of a pelletizing machine and pellet chamber."

Please amend the application as follows:

**"DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT"**

On page 1, please replace the paragraph beginning with line 3, with the following rewritten paragraph:

"This invention relates to a method for manufacturing feed pellets, whereby moist feed pellets are subjected to negative pressure followed by a drying process, in order to achieve a more porous pellet and a lower temperature load."

On page 1, please replace the paragraph beginning with line 12, with the following rewritten paragraph:

"Feed pellets for fish and animals are manufactured on an industrial scale in a multi-stage process. The components are mixed to a dough-like body, which is formed into pellets by high pressure and high temperature, for example in a so-called extruder, after which the pellets are dried and cooled. As warm pellets, typically holding 100 to 140°C, are pressure relieved to ambient pressure, the pellets expand because of the release of internal pressure and liquid boils out of the pellets. The expansion results in the pellets having a porous structure."

Please replace the paragraph on page 2, beginning with line 3, with the following rewritten paragraph:

"The pellets are cut into pieces of desired length. Considerable remaining moisture in the expanded pellet is generally undesirable, therefore, the pellets may be dried to obtain a desired level of quality. Such drying may be done in several ways, and some of the methods should be well known to a person skilled in the art."

On page 2, please replace the paragraph beginning line 8, with the following rewritten paragraph:

"The porosity or specific gravity of the completely formed product may be an important criterion for quality of several types of food and feed products, including feed pellets for reared fish. The porosity of the product is of importance to the possibility of adding liquid nutrients which are absorbed into the product; the porosity is further of importance to floating capacities in a suitable medium, and it is of importance to the texture criterions like crispness, mouth sensation and toughness. To pellets of fish feed the porosity is important with respect to the ability of the pellets to absorb oil in the production process, and for the floating capacity/buoyancy in water on feeding."

Please replace the paragraph on page 2, beginning with line 20, with the following rewritten paragraph:

"Existing methods of manufacturing are hard to control accurately, in order for

the product to have the desired porosity or sufficient porosity for the products, feed substances, and/or feed pellets to achieve a desired absorption of fat."

Please replace the paragraph beginning on page 2, line 25, with the following rewritten paragraph:

"For some products it will be important to be able to control the production process towards a minimum of expansion in, for example pellets, whereas the opposite will be the case for other products. In producing, among other things, feeds for pets such as for example dogs and cats, and feed for reared fish, this possibility of controlling the degree of expansion/porosity is essential, because the aim is often to enable addition of as much fat/oil as possible in a subsequent processing stage for pellets to be fed to fish. For fish feed the control of its degree of expansion is particularly important because such feed should, in addition, exhibit defined sinking capacities in water after its fat/oil absorption."

On page 3, please replace the paragraph beginning with line 23, with the following rewritten paragraph:

"An object of the invention is to provide a method and a plant of the initially mentioned kinds, for use in the manufacturing of porous pellets, whereby a better control of the porosity of the feed product is obtained as compared to the known techniques."

On page 3, please replace the paragraph beginning on line 28, with the following rewritten paragraph:

"Another object is to achieve a lower temperature load on the product through the processing. Since known methods normally require an extra supply of energy, such as heat, to achieve increased expansion, the opposite effect of what was normally to be expected has been achieved by means of the invention. By the use of negative pressure, also in the subsequent drying process, and possibly a deep-frying process, an essentially lower temperature load can be achieved for the product as compared to conventional methods."

On page 4, please replace the paragraph beginning on line 7, with the following rewritten paragraph:

"In a method of the kind specified initially, this object is realized by proceeding in accordance with the claims, and by a plant of the initially specified kind for the implementation of the method, being formed so that it exhibits the features stated in the claims."

On page 4, please replace the paragraph beginning on line 24, with the following rewritten paragraph:

"In practice, formation of pellets is normally achieved by extruding pellets in a manner known in itself, but with the important difference of the extruder discharging the pellets into said pellet chamber which works by reduced pressure. The use of reduced pressure will in this connection provide improved cooling, i.e. smaller temperature load on the feed, and increased evaporation of water binding heat. Pellets subjected to reduced pressure will also expand more than usual, and increased evaporation of water contributes to the attainment of a more porous pellet. The expansion may be adjusted by adjusting the negative pressure. Exposure of extruded pellets to low pressure in the pellet chamber may be of a short duration, in typical cases from a few seconds up to one minute, after which the pellets are passed to a drying process."

On page 5, please replace the paragraph beginning on line 10, with the following rewritten paragraph:

The pellet temperature generally drops from about 90 to about 50°C when the pressure (inside the pellet chamber) is reduced from 1000 to 200 millibar. At the same time the pellet becomes more porous after the negative pressure treatment, as the density (less weight per unit of volume) decreases from about 450 to 280 grams per liter of pellets. Pressure lower than 200 millibar may also have a favorable effect on the control of the porosity of the feed pellets."

On page 5, please replace the paragraph beginning with line 19, with the

following rewritten paragraph:

"The table below shows the results obtained in a series of experiments with extruded fish feed by the use of the method and plant according to the invention. The results show a marked increase in the pellet diameter and a reduction in the bulk density as a measurement of expansion when the pressure inside the pellet chamber is reduced from 1000 millibar to 200 millibar. The temperature of the product also decreases by dropping pressure, as a consequence of increased evaporation. The experiment referred to, is only illustrative and not limiting to the scope of the application."

On page 6, please replace the paragraph beginning with line 2, with the following rewritten paragraph:

"In the experiments mentioned the period of exposure to negative pressure in the pelletizing chamber was 20 seconds. Experiments with continuous discharging from the pellet chamber (i.e. exposure duration of less than 5 seconds), and an exposure duration of 40 seconds, have shown corresponding results for expansion, as those stated above."

On page 6, please replace the paragraph beginning at line 16, with the following rewritten paragraph:

"It has proved convenient to let the subsequent drying process also be implemented by a pressure which is lower than the ambient pressure. This stage of the method is advantageous in that it favors the attainment of the object aimed at, but this stage may also be eliminated in the implementation of the method to achieve a satisfactory result. The same applies to the deep-frying process which is implemented by reduced pressure in a tank filled with oil, whereby the deep-frying process constitutes said subsequent drying treatment. For the rest, the drying process may be implemented in a known manner, for example by drying in air."

On page 7, please replace the paragraph beginning on line 16, with the following rewritten paragraph:

"As mentioned, reduced temperature will be favorable to temperature sensitive components, and increased porosity is favorable to improve the capacity of the pellets to absorb oil, whether the oil is added in connection with the deep-frying, or the oil is added after the pellets have been dried in another way (for example by drying in warm air)."

On page 7, please replace the paragraph beginning with line 26, with the following rewritten paragraph:

"According to the invention pellets are produced in a pelletizing machine and passed from the pelletizing machine into said pellet chamber which operates at reduced pressure. The degree of negative pressure relative to the atmospheric pressure is adjusted with a view to the desired expansion of pellets. This method has turned out to provide an essentially better control of the expansion and porosity of the pellets, than measures which have to be taken in a known manner before or during pelletizing. The reason is believed to be that in changing single parameters of the pelletizing process, other parameters are also influenced, which may provide desired results. This is because the pelletizing process creates physical and chemical structures of the raw materials by means of the same measures that control expansion (heat, water and pressure)."

On page 8, please replace the paragraph beginning on line 12, with the following rewritten paragraph:

"One may hypothesize that the same effect as by the invention may be achieved by increasing the pressure during pelletizing, and producing pellets into free air with the same pressure drop as achieved by the invention. However, such a pelletizing pressure increase does not have that effect. Pelletizing will normally occur with pressure variations, in for example the extruding process, exceeding 1 atmosphere (about 1000 millibar), without significantly affecting expansion and porosity. In the production of animal feeds the pressure before pelletizing may be between 15 and 40 atmospheres, depending on the choice of raw materials and desired quality of the final product. Pressure is one, but not the most essential process parameter for adjusting the

expansion."

On page 8, please replace the paragraph beginning at line 26, with the following rewritten paragraph:

"As an explanation of the surprising effect obtained by the application of the invention, a more rapid boiling out of water and subsequent temperature drop are considered to enhance acquisition of a desired level of quality of pellet. The drop in temperature results in the pellet matrix setting, thereby preventing the shrinking effect which is otherwise to be expected."

On page 9, please replace the paragraph beginning at line 1, with the following rewritten paragraph:

"The pressure within the pellet chamber may be in the pressure range from 0 millibar to below atmospheric pressure, and will in typical cases be between 100 and 800 millibar."

On page 9, please replace the paragraph beginning at line 4, with the following rewritten paragraph:

"According to the method of the invention, porous pellets are produced in a known manner, but with the novel feature of pellets being discharged into a pellet chamber which is kept at a pressure lower than the ambient pressure, typically in the range from one hundred to eight hundred millibar."

On page 9, please replace the paragraph beginning with line 10, with the following rewritten paragraph:

"According to the method of the invention, water may be removed from the pellets, and the pores may be filled with fat in subsequent processing stages."

On page 9, please replace the paragraph beginning with line 13, with the following rewritten paragraph:

"According to the invention the outlet of pelletizing equipment may have a pellet chamber engaged thereto, which is arranged to be maintained at a lower pressure than the surroundings, and which is provided with a gate lock opening so that pellets may be drawn continuously, or in batches, from the pellet chamber, while the chamber is maintained at a reduced pressure."

On page 9, please replace the paragraph beginning at line 20, with the following rewritten paragraph:

"In the following the invention will be described in further detail by means of the claims, and reference is made to the accompanying drawing, in which the single figure shows a schematic side view of a plant for the manufacturing of pellets."

On page 9, please replace the paragraph beginning at line 25, with the following rewritten paragraph:

"In the figure of the drawing the reference numeral 1 identifies a pelletizing machine with an outlet 2 which opens into a pellet chamber 3. The pellet chamber 3 has a first vacuum pump 4 arranged thereto, which is arranged to maintain the air pressure inside the pellet chamber 3 at a first desired value, lower than the ambient pressure. At its lower end, the pellet chamber 3 is provided with an outlet 5, in which there is positioned a gate lock device 6, so that the low pressure of the pellet chamber 3 may be maintained while the pellet is discharged. The gate lock device 6 may be of a rotational type, so that pellets may be fed continuously out of the pellet chamber 3."

On page 10, please replace the paragraph beginning at line 9, with the following rewritten paragraph:

"The outlet 5 is connected to an inlet 7 in the upper part of an oil tank 8 which is partially filled with oil, which is not shown. The oil tank 8 has a second vacuum pump 9 arranged thereto, which is arranged to maintain the air pressure inside the oil tank 8 at a second

desired value, which is lower than the ambient pressure and normally also lower than said first desired value of the pellet chamber 3. Further, the oil tank 8 may be provided with a heating element with thermostatic control, possibly an agitator, which is not shown, in order to serve for the deep-frying of pellets."

Following page 10, please insert page 11 as follows:

**"ABSTRACT**

A method for manufacturing feed pellets, and a plant for the implementation of this method have been explained. The aim has been to improve the manufacturing of porous pellets, first and foremost to achieve a better control of the porosity of the pellets than the known techniques. The pellets come from a pelletizing machine (1) into a pellet chamber (3) which is kept at a pressure lower than the ambient pressure. From the chamber (3) the pellets are passed through an outlet (5) having a gate lock body (6)."

**IN THE CLAIMS**:

Please add new claims 9-22 as follows:

9. A method for manufacturing feed pellets having an initial pore volume and fat content said method comprising:

A. extruding pellets from a feed material within a pellet extruder having a discharge nozzle;

B. exposing said extruded pellets to a pressure lower than ambient pressure immediately subsequent to said extruding step, said exposure to a pressure lower than ambient pressure occurring in a pellet chamber downstream from said discharge nozzle, whereby said pellets expand and increase said pore volume;

C. drying said pellets exposed to said pressure; and

D. adding oil to said pellets to increase said fat content for said pellets.

10. The method according to claim 9, wherein said adding step occurs during said drying

step.

11. The method according to claim 9, wherein said pellets are exposed to said pressure for a period of time not exceeding one minute, said drying step comprising exposure of said pellets to a second pressure, said second pressure being lower than ambient pressure, said drying step further comprising drying at a temperature below 100 degrees Celsius.

12. The method according to claim 11, wherein said pressure and said second pressure are different from each other.

13. The method according to claim 9, said drying step comprising an oil bath acting as a deep-frying treatment.

14. A plant for manufacturing feed pellets said plant comprising:

A. a pelletizing machine constructed and arranged for shaping said pellets;

B. a pellet chamber adjacent to and downstream from said pelletizing machine, said pellet chamber having an outlet, said pellet chamber being constructed and arranged to expose said pellets to a pressure lower than ambient pressure; and

C. a tank containing oil, said tank being in communication with said outlet, said tank comprising a deep-frying container, said tank being constructed and arranged to expose said pellets to a second pressure lower than ambient pressure.

15. The plant according to claim 14, wherein said pressure is between 100 and 800 millibars.

16. The plant according to claim 14, wherein said second pressure is between 100 and 800 millibars.

17. The plant according to claim 14, wherein said pressure and said second pressure are different from each other.

18. The plant according to claim 14, further comprising a lock body between said pellet chamber and said tank.

19. The plant according to claim 18, wherein said lock body rotates, said lock body being constructed and arranged to move pellets out of said pellet chamber.

20. The plant according to claim 18, said pellet chamber comprising a first vacuum pump, said first vacuum pump constructed and arranged to maintain said pellet chamber at said pressure lower than said ambient pressure, said tank comprising a second vacuum pump, said second vacuum pump constructed and arranged to maintain said second pressure lower than said ambient pressure.

21. The plant according to claim 20, wherein said second pressure is different from said pressure.

22. The plant according to claim 21, wherein said second pressure is lower than said pressure.

Applicant respectfully requests entry and consideration of the amendments to the specification and the addition of new claims herein. Applicant has attached hereto a marked-up version of the specification for the convenience of the Examiner as entitled "Marked-Up Version".

Respectfully submitted,

VIDAS, ARRETT & STEINKRAUS

Date: September 21, 2001

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**Marked-Up Version**

A METHOD [OF] FOR MANUFACTURING FEED PELLETS AND A PLANT FOR USE IN THE IMPLEMENTATION OF THE METHOD

This invention relates to a method [of] for manufacturing feed pellets, whereby moist feed pellets are subjected to negative pressure followed by a drying process, in order to achieve a more porous pellet and a lower temperature load.

The invention also relates to a plant for use in the implementation of the method, the plant generally comprising a pellet chamber, preferably interconnected downstream of a pelletizing machine, an extruding device for pellets or a similar pellet forming device.

Feed pellets for fish and animals are manufactured on an industrial scale in a multistage process. The components are mixed to a dough-like body, which is formed into pellets by high pressure and high temperature, for example in a so-called extruder, after which the pellets are dried and cooled. As warm pellets, typically holding 100 to 140°C, are pressure relieved to ambient pressure, the pellets expand because of the release of internal pressure and liquid [boiling] boils out of the pellets. The expansion results in the pellets having a porous structure.

The pellets are cut into pieces of desired length. Considerable remaining moisture in the expanded pellet is generally undesirable, [involves that] therefore the pellets [have to] may be dried to obtain [keeping] a desired level of quality. Such drying may be done in several ways, and some of [them] the methods should be well known to a person skilled in the art.

The porosity or specific gravity of the completely formed product may be an important criterion [of] for quality of several types of food and feed products, including feed pellets for reared fish. The porosity of the product is of importance to the possibility of adding liquid nutrients which are abosrbed into the product; the porosity is further of importance to floating capacities in a suitable medium, and it is of importance to the texture criterions like crispness, mouth sensation and toughness. To pellets of fish feed the porosity is important with respect to the ability of the pellets to absorb oil in the production process, and for the floating

capacity/buoyancy in water on feeding.

Existing methods of manufacturing are hard to control accurately, in order for the product to have the desired porosity or sufficient porosity for the products, feed substances, and/or feed pellets [etc.] to achieve [the] a desired absorption of fat.

For some products it will be important to be able to control the production process towards a minimum of expansion in, for example pellets, whereas the opposite will be the case for other products. In producing, amoung other things, feeds for pets such as for example dogs and cats, and feed for reared fish, this possibility of controlling the degree of expansion/porosity is essential, because the aim is often to enable addition of as much fat/oil as possible in a subsequent processing stage for pellets to be fed to fish. For fish feed the control of its degree of expansion is particularly important because such feed should, in addtion, exhibit defined sinking capabilities in water after its fat/oil absorption.

The most common method of increasing the porosity is to increase the mechanical and thermal amount of energy added to the raw materials in the extruding stage of the manufacturing process. When the initial mixture contains surplus vapor after extrusion, the surplus vapour will expand and result in greater porosity. It is also possible to supply compressed gas to the extruder, as disclosed in US patent document No. 5 587 193. In patent publication WO 9503711 and 9816121 are mentioned means for reducing porosity after the extruding stage by extracting positive pressure and surplus vapour inside the extruder. In US patent document No. 5 527 553 is explained a method, in which the pellets are passed directly into a warm oil bath at 107-232°C and cut into a desired length in the oil bath. The degree of expansion of pellets is controlled by changing the oil temperature.

An object of the invention is to provide a method and a plant of the initially mentioned kinds, for use in the manufacturing of porous pellets, whereby a better control of the porosity of the feed product [than by] is obtained as compared to the known [technique] techniques. [may be maintained.]

Another object is to achieve a lower temperature load on the product through the processing. Since known methods normally require an extra supply of energy, such as heat, to

achieve increased expansion, the opposite effect of what was normally to be expected has been achieved by means of the invention. By the use of negative pressure also in the subsequent drying process, and possibly a deep-frying process, an essentially lower temperature load can be achieved for the product [than by] as compared to conventional methods.

In a method of the kind specified initially, this object is realized by proceeding in accordance with the [characterizing part of the following claim 1] claims, and by a plant of the initially specified kind for the implementation of the method, being formed so that it exhibits the features stated in the [characterizing part of claim 9] claims.

According to the invention the procedure is such that the pellet is produced, discharged by, or extruded by a pressure which is lower than the ambient pressure, pellets being transferred, after a relatively short stay by said reduced pressure, to a drying process.

A plant for the implementation of this method comprises a pellet chamber which is interconnected in the plant, downstream of the pelletizing machine, and the plant excels by said pellet chamber being arranged to be able to be kept at a lower pressure than the ambient pressure, for example in the order of 100-800 millibar.

In practice, [this] formation of pellets is normally [done] achieved by extruding pellets in a manner known in itself, but with the important difference of the extruder discharging the pellets into said pellet chamber which works by reduced pressure. The use of reduced pressure will in this connection provide improved cooling, i.e. a [small] smaller temperature load on the feed, and increased evaporation of water binding heat. Pellets subjected to reduced pressure will also expand more than usual, and increased evaporation of water contributes to the attainment of a more porous pellet. The expansion may be adjusted by adjusting the negative pressure. [So far, experiments carried out have shown that the pellets' stay by] Exposure of extruded pellets to low pressure in the pellet chamber may be of a short duration, in typical cases from a few seconds up to one minute, after which the pellets are passed to a drying process.

[Experiments have shown that the] The pellet temperature generally drops from about 90 to about 50°C when the pressure (inside the pellet chamber) is reduced from 1000 to 200 millibar. At the same time the pellet becomes more porous after the negative pressure

treatment, as the density (less weight per unit of volume) decreases from about 450 to 280 grams per [litre] liter of pellets. [Other experiments have shown that also pressure] Pressure lower than 200 millibar [has] may also have a [favourable] favorable effect on the control of the porosity of the feed pellets.

The table below shows the results obtained in a series of experiments with extruded fish feed by the use of the method and plant according to the invention. The results show a marked increase in the pellet diameter and a reduction in the bulk density as a measurement of expansion when the pressure inside the pellet chamber is reduced from 1000 [mbar] millibar to 200 [mbar] millibar. The temperature of the product also decreases by dropping pressure, as a consequence of increased evaporation. The experiment referred to, is only illustrative and not limiting to the scope of the application.

| Absolute pressure (mbar) | Pellet diameter (mm) | Bulk density 9g/l) | Temperature of pellets (°C) | Evaporation of water (g/kg of feed) |
|---|---|---|---|---|
| 1000 | 8.3 | 460 | 91.2 | 5 |
| 800 | 9 | 416 | 80.5 | 6 |
| 600 | 9.1 | 368 | 70.4 | 11 |
| 300 | 10 | 296 | 59.8 | - |
| 200 | 10.2 | 284 | 52 | 15 |

In the experiments mentioned the period of [stay by] exposure to negative pressure in the pelletizing chamber was 20 seconds. Experiments with continuous discharging from the pellet chamber (i.e. [a stay] exposure duration of less than 5 seconds), and [a stay] an exposure duration of 40 seconds, have shown corresponding results for expansion, as those stated above."

A plant for use in the manufacturing of feed pellets excels, according to the

invention, by the pellet chamber being arranged to allow itself to be kept at a lower pressure than the ambient pressure, its outlet being connected to an oil tank or a drying plant, to which the pellet is transferred, and wherein the oil tank or the drying plant is also arranged to be able to maintain a lower pressure than that of the surroundings.

It has proved convenient to let the subsequent drying process also be implemented by a pressure which is lower than the ambient pressure. This stage of the method is advantageous in that it [favours] favors the attainment of the object aimed at, but this stage [is not critical] may also be eliminated in the implementation of the method to achieve a satisfactory result. The same applies to the deep-frying process which is implemented by reduced pressure in a tank filled with oil, whereby the deep-frying process constitutes said subsequent drying treatment. For the rest, the drying process may be [carried through] implemented in a known manner, for example by drying in air.

Also the invention comprises a method whereby the pelletizing is carried out by a first reduced pressure, whereas the subsequent drying is implemented at a second reduced pressure.

Said first pressure and said second pressure may be identical or different from each other.

As mentioned, reduced temperature will be [favourable] favorable to temperature sensitive components, and increased porosity is [favourable] favorable to improve the capacity of the pellets to absorb oil, whether the oil is added in connection with the deep-frying, or the oil is added after the pellets have been dried in another way (for example by drying in warm air).

The outlet of the pellet chamber may have a rotatable gate lock body arranged thereto, enabling formed pellets to be drawn continuously or in batches, while, at the same time, the negative pressure is maintained.

According to the invention pellets are produced in a pelletizing machine and passed from [there] the pelletizing machine into said pellet chamber which [works] operates at reduced pressure. The degree of negative pressure relative to the atmospheric pressure is adjusted with a view to the desired expansion of pellets. This method has turned out to provide

an essentially better control of the expansion and porosity of the pellets, than measures which have to be taken in a known manner before or during pelletizing. The reason is believed to be that in changing single parameters of the pelletizing process, other parameters are also influenced, which [are very important for a good result] may provide desired results. This is because the pelletizing process creates physical and chemical structures of the raw materials by means of the same measures that control expansion (heat, water and pressure).

One [should perhaps believe] may hypothesize that the same effect as by the invention [could] may be achieved by increasing the pressure [by] during pelletizing, and producing pellets into free air with the same pressure drop as [the one] achieved by the invention. However, such a pelletizing pressure increase does not have that effect. [There] Pelletizing will normally [be operated] occur with pressure variations, in for example the extruding process, [way over] exceeding 1 atmosphere (about 1000 millibar), without [this] significantly affecting expansion and porosity [in a manner worth mentioning]. In the production of animal feeds the pressure before pelletizing [will] may be between 15 and 40 atmospheres, depending on the choice of raw materials and desired quality of the final product. Pressure is one, but not the most essential process parameter for adjusting the expansion.

As an explanation of the surprising effect obtained by the application of the invention, a more rapid boiling out of water and subsequent temperature drop are considered to [be the most important ones] enhance acquisition of a desired level of quality of pellet. The drop in temperature results in the pellet matrix setting, thereby preventing the shrinking effect which is otherwise to be expected.

The pressure within the pellet chamber may be in the pressure range from 0 millibar to [right] below atmospheric pressure, and will in typical cases be between 100 and 800 millibar.

According to the method of the invention, porous pellets are produced in a known manner [known in itself], but with the novel feature of pellets being discharged into a pellet chamber which is kept at a pressure lower than the ambient pressure, typically in the range from one hundred to eight hundred millibar.

According to the method of the invention, water [is] may be removed from the pellets, and the pores [are] may be filled with fat in subsequent processing stages.

According to the invention the outlet of [known] pelletizing equipment [has] may have a pellet chamber [arranged] engaged thereto, which is arranged to be [able to be kept] maintained at a lower pressure than the surroundings, and which is provided with a gate lock opening so that pellets may be drawn continuously, or in batches, from the pellet chamber, while the chamber is [kept by] maintained at a reduced pressure.

In the following the invention will be described in further detail by means of [an exemplary embodiment] the claims, and reference is made to the accompanying drawing, in which the single figure shows a schematic side view of a plant for the manufacturing of pellets.

In the figure of the drawing the reference numeral 1 identifies a pelletizing machine with an outlet 2 which opens into a pellet chamber 3. The pellet chamber 3 has a first vacuum pump 4 arranged thereto, which is arranged to maintain the air pressure inside the pellet chamber 3 at a first desired value, lower than the ambient pressure. At its lower end, the pellet chamber 3 is provided with an outlet 5, in which there is positioned a gate lock device 6 [of a known type], so that the low pressure of the pellet chamber 3 may be maintained while the pellet is discharged. The gate lock device 6 may [with advantage] be of a rotational type, so that pellets may be fed continuously out of the pellet chamber 3.

The outlet 5 is connected to an inlet 7 in the upper part of an oil tank 8 which is partially filled with oil, which is not shown. The oil tank 8 has a second vacuum pump 9 arranged thereto, which is arranged to maintain the air pressure inside the oil tank 8 at a second desired value, which is lower than the ambient pressure and normally also lower than said first desired value of the pellet chamber 3. Further, the oil tank 8 [is] may be provided[, in a known manner,] with a heating element with thermostatic control, possibly an agitator, which is not shown, in order to serve for the deep-frying of pellets.

PCT/NO00/00093





# A METHOD OF MANUFACTURING FEED PELLETS AND PLANT FOR USE IN THE IMPLEMENTATION OF THE METHOD

This invention relates to a method of manufacturing feed pellets, whereby moist feed pellets are subjected to negative pressure followed by a drying process, in order to achieve a more porous pellet and a lower temperature load.

The invention also relates to a plant for use in the implementation of the method, the plant generally comprising a pellet chamber, preferably interconnected downstream of a pelletizing machine, an extruding device for pellets or a similar pellet forming device.

Feed pellets for fish and animals are manufactured on an industrial scale in a multistage process. The components are mixed to a dough-like body, which is formed into pellets by high pressure and high temperature, for example in a so-called extruder, after which the pellets are dried and cooled. As warm pellets, typically holding 100 to 140°C, are pressure relieved to ambient pressure, the pellets expand because of the internal pressure and liquid boiling out of

the pellets. The expansion results in the pellets having a porous structure.

The pellets are cut into pieces of desired length. Considerable remaining moisture in the expanded pellet involves that the pellets have to be dried to obtain keeping quality. Such drying may be done in several ways, and some of them should be well known to a person skilled in the art.

The porosity or specific gravity of the completely formed product may be an important criterion of quality of several types of food and feed products, including feed pellets for reared fish. The porosity of the product is of importance to the possibility of adding liquid nutrients which are absorbed into the product; the porosity is further of importance to floating capacities in a suitable medium, and it is of importance to the texture criterions like crispness, mouth sensation and toughness. To pellets of fish feed the porosity is important with respect to the ability of the pellets to absorb oil in the production process, and for the floating capacity/buoyancy in water on feeding.

Existing methods of manufacturing are hard to control accurately, in order for the product to have the desired porosity or sufficient porosity for the products, feed substances, feed pellets etc. to achieve the desired absorption of fat.

For some products it will be important to be able to control the production process towards a minimum of expansion in for example pellets, whereas the opposite will be the case for other products. In producing, among other things, feeds for pets such as for example dogs and cats, and feed for reared

fish, this possibility of controlling the degree of expansion/porosity is essential, because the aim is often to enable addition of as much fat/oil as possible in a subsequent processing stage. For fish feed the control of its degree of expansion is particularly important because such feed should, in addition, exhibit defined sinking capacities in water after its fat/oil absorption.

The most common method of increasing the porosity is to increase the mechanical and thermal amount of energy added to the raw materials in the extruding stage of the manufacturing process. When the initial mixture contains surplus vapour after extrusion, the surplus vapour will expand and result in greater porosity. It is also possible to supply compressed gas to the extruder, as disclosed in US patent document No. 5 587 193. In patent publications WO 9503711 and 9816121 are mentioned means for reducing porosity after the extruding stage by extracting positive pressure and surplus vapour inside the extruder. In US patent document No. 5 527 553 is explained a method, in which the pellets are passed directly into a warm oil bath at 107-232 °C and cut into a desired length in the oil bath. The degree of expansion of pellets is controlled by changing the oil temperature.

An object of the invention is to provide a method and a plant of the initially mentioned kinds, for use in the manufacturing of porous pellets, whereby a better control of the porosity of the feed product than by known technique may be maintained.

Another object is to achieve a lower temperature load on the product through the processing. Since known methods normally require an extra supply of energy, such as heat, to achieve

increased expansion, the opposite effect of what was normally to be expected has been achieved by means of the invention. By the use negative pressure also in the subsequent drying process and possibly a deep-frying process, an essentially lower temperature load can be achieved for the product than by conventional methods.

In a method of the kind specified initially, this object is realized by proceeding in accordance with the characterizing part of the following claim 1, and by a plant of the initially specified kind for the implementation of the method, being formed so that it exhibits the features stated in the characterizing part of claim 9.

According to the invention the procedure is such that the pellet is produced, discharged by or extruded by a pressure which is lower than the ambient pressure, pellets being transferred, after a relatively short stay by said reduced pressure, to a drying process.

A plant for the implementation of this method comprises a pellet chamber which is interconnected in the plant, downstream of the pelletizing machine, and the plant excels by said pellet chamber being arranged to be able to be kept at a lower pressure than the ambient pressure, for example in the order of 100-800 millibar.

In practice this is normally done by extruding pellets in a manner known in itself, but with the important difference of the extruder discharging the pellets into said pellet chamber which works by reduced pressure. The use of reduced pressure will in this connection provide improved cooling, i.e. a small temperature load on the feed, increased evaporation of

water binding heat. Pellets subjected to reduced pressure will also expand more than usual, and increased evaporation of water contributes to the attainment of a more porous pellet. The expansion may be adjusted by adjusting the negative pressure. So far, experiments carried out have shown that the pellets' stay by low pressure may be of a short duration, in typical cases from a few seconds up to one minute, after which the pellets are passed to a drying process.

Experiments have shown that the pellet temperature drops from about 90 to about 50°C when the pressure (inside the pellet chamber) is reduced from 1000 to 200 millibar. At the same time the pellet becomes more porous after the negative pressure treatment, as the density (less weight per unit of volume) decreases from about 450 to 280 grams per litre of pellets. Other experiments have shown that also pressure lower than 200 millibar has a favourable effect on the control of the porosity of the feed pellets.

The table below shows the results obtained in a series of experiments with extruded fish feed by the use of the method and plant according to the invention. The results show a marked increase in the pellet diameter and a reduction in the bulk density as a measurement of expansion when the pressure inside the pellet chamber is reduced from 1000 mbar to 200 mbar. The temperature of the product also decreases by dropping pressure, as a consequence of increased evaporation. The experiment referred to, is only illustrative and not limiting to the scope of the application.

| Absolute pressure (mbar) | Pellet diameter (mm) | Bulk density (g/l) | Temperature of pellets (°C) | Evaporation of water (g/kg of feed) |
|---|---|---|---|---|
| 1000 | 8.3 | 460 | 91.2 | 5 |
| 800 | 9 | 416 | 80.5 | 6 |
| 600 | 9.1 | 368 | 70.4 | 11 |
| 300 | 10 | 296 | 59.8 | - |
| 200 | 10.2 | 284 | 52 | 15 |

In the experiments mentioned the period of stay by negative pressure in the pelletizing chamber was 20 seconds. Experiments with continuous discharging from the pellet chamber (i.e. a stay of less than 5 seconds), and a stay of 40 seconds have shown corresponding results for expansion, as those stated above.

A plant for use in the manufacturing of feed pellets excels, according to the invention, by the pellet chamber being arranged to allow itself to be kept at a lower pressure than the ambient pressure, its outlet being connected to an oil tank or a drying plant, to which the pellet is transferred, and wherein the oil tank or the drying plant is also arranged to be able to maintain a lower pressure than that of the surroundings.

It has proved convenient to let the subsequent drying process also be implemented by a pressure which is lower than the

ambient pressure. This stage of the method is advantageous in that it favours the attainment of the object aimed at, but this stage is not critical in the implementation of the method to achieve a satisfactory result. The same applies to the deep-frying process which is implemented by reduced pressure in a tank filled with oil, whereby the deep-frying process constitutes said subsequent drying treatment. For the rest, the drying process may be carried through in a known manner, for example by drying in air.

Also, the invention comprises a method whereby the pelletizing is carried out by a first reduced pressure, whereas the subsequent drying is implemented at a second reduced pressure.

Said first pressure and said second pressure may be identical or different from each other.

As mentioned, reduced temperature will be favourable to temperature sensitive components, and increased porosity is favourable to the capacity of the pellets to absorb oil, whether the oil is added in connection with the deep-frying, or the oil is added after the pellets have been dried in another way (for example by drying in warm air).

The outlet of the pellet chamber may have a rotatable gate lock body arranged thereto, enabling formed pellets to be drawn continuously or in batches, while, at the same time, the negative pressure is maintained.

According to the invention pellets are produced in a pelletizing machine and passed from there into said pellet chamber which works at reduced pressure. The degree of

negative pressure relative to the atmospheric pressure is adjusted with a view to the desired expansion of pellets. This has turned out to provide an essentially better control of the expansion and porosity, than measures which have to be taken in a known manner before or during pelletizing. The reason is believed to be that in changing single parameters of the pelletizing process, other parameters are also influenced, which are very important for a good result. This is because the pelletizing process creates physical and chemical structures of the raw materials by means of the same measures that control expansion (heat, water and pressure).

One should perhaps believe that the same effect as by the invention could be achieved by increasing the pressure by pelletizing and producing pellets into free air with the same pressure drop as the one achieved by the invention. However, such a pressure increase does not have that effect. There will normally be operated with pressure variations, in for example the extruding process, way over 1 atmosphere (about 1000 millibar), without this affecting expansion and porosity in a manner worth mentioning. In the production of animal feeds the pressure before pelletizing will be between 15 and 40 atmospheres, depending on the choice of raw materials and desired quality of the final product. Pressure is one, but not the most essential process parameter for adjusting the expansion.

As an explanation of the surprising effect obtained by the application of the invention, a more rapid boiling out of water and subsequent temperature drop are considered to be the most important ones. The drop in temperature results in the pellet matrix setting, thereby preventing the shrinking effect which is otherwise to be expected.

The pressure within the pellet chamber may be in the pressure range from 0 millibar to right below atmospheric pressure, and will in typical cases be between 100 and 800 millibar.

According to the method of the invention, porous pellets are produced in a manner known in itself, but with the novel feature of pellets being discharged into a pellet chamber which is kept at a pressure lower than the ambient pressure, typically in the range from one hundred to eight hundred millibar.

According to the method of the invention, water is removed from the pellets, and the pores are filled with fat in subsequent processing stages.

According to the invention the outlet of known pelletizing equipment has a pellet chamber arranged thereto, which is arranged to be able to be kept at a lower pressure than the surroundings, and which is provided with a gate lock opening so that pellets may be drawn continuously or in batches from the pellet chamber, while the chamber is kept by a reduced pressure.

In the following the invention will be described in further detail by means of an exemplary embodiment, and reference is made to the accompanying drawing, in which the single figure shows a schematic side view of a plant for the manufacturing of pellets.

In the figure of the drawing the reference numeral 1 identifies a pelletizing machine with an outlet 2 which opens into a pellet chamber 3. The pellet chamber 3 has a first vacuum pump 4 arranged thereto, which is arranged to maintain

the air pressure inside the pellet chamber 3 at a first desired value, lower than the ambient pressure. At its lower end, the pellet chamber 3 is provided with an outlet 5, in which there is positioned a gate lock device 6 of a known type, so that the low pressure of the pellet chamber 3 may be maintained while the pellet is discharged. The gate lock device 6 may with advantage be of a rotational type, so that pellets may be fed continuously out of the pellet chamber 3.

The outlet 5 is connected to an inlet 7 in the upper part of an oil tank 8 which is partly filled with oil, which is not shown. The oil tank 8 has a second vacuum pump 9 arranged thereto, which is arranged to maintain the air pressure inside the oil tank 8 at a second desired value, which is lower than the ambient pressure and normally also lower than said first desired value of the pellet camber 3. Further, the oil tank 8 is provided, in a known manner, with a heating element with thermostatic control, possibly an agitator, which is not shown, in order to serve for the deep-frying of pellets.

# Amended Claims

1. A method of manufacturing feed pellets having a relatively high fat content, e.g. in the form of added oil and which, during manufacturing, are processed in an atmosphere exhibiting a pressure lower than ambient pressure, and wherein the pellets are subjected to a drying process, characterized in that a pressure reduction is put on immediately subsequently to a pellet extrusion process, within a pellet chamber at the downstream side of the pellet extruder's discharge nozzle, in order to cause the pellet material to expand and bring about an increase in pore volume rendering possible a high fat content in the finished feed pellets.

2. A method as claimed in claim 1, characterized in that the pellets are subjected to said reduced pressure for a period of time in the order of a few seconds up to about one minute, and that the following drying process is carried out at a reduced pressure in relation to the environment, at a temperature lower than 100°C.

3. A method as claimed in claim 2, characterized in that the drying process is carried out in an oil bath which also acts as a deep-frying treatment.

4. A method as claimed in claim 1, 2 or 3, characterized in that an after-treatment immediately following the pellet extrusion, downstream of the discharge nozzle, is carried out at a first

reduced pressure, the subsequently following drying process being carried out at a second reduced pressure.

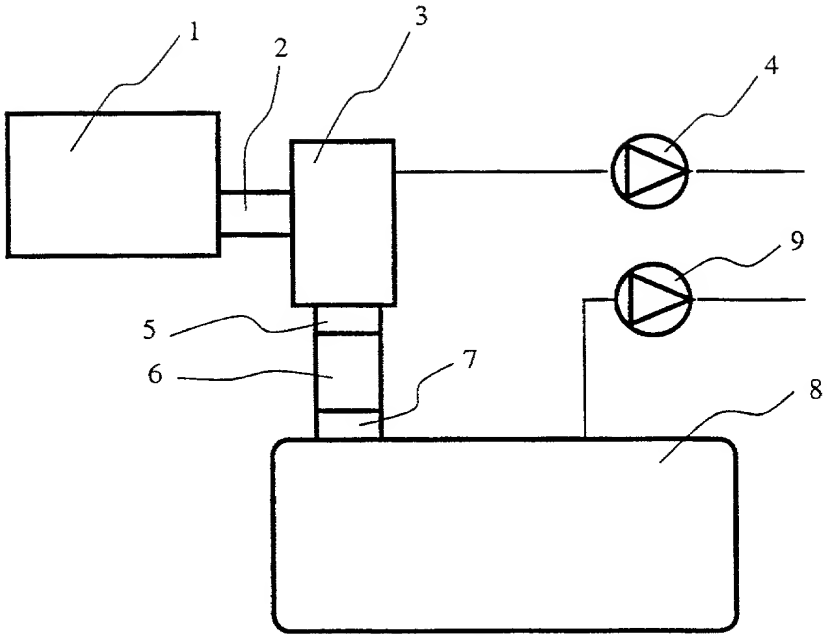
5. A plant for use in implementing the method as defined in claim 1, comprising a pellet chamber (3), preferably incorporated into the plant immediately following a pelletizing machine (1), an extrusion device for pellets or a similar apparatus for shaping pellets or blanks for pellets, as well as a tank (8) containing oil, c h a r a c t e r i z e d i n that the pellet chamber (3)is adapted to be kept at a lower pressure than ambient pressure, e.g. in the order of 100-800 millibar, said pellet chamber (3) having an outlet (5) which, directly or indirectly, leads into said oil tank (8) constituting a deep-frying container and, moreover, is adapted to be kept at a pressure lower than ambient pressure, e.g. in the order of 100-800 millibar.

6. A plant as claimed in claim 5, c h a r a c t e r i z e d i n that between the pellet chamber (3) and the oil tank (8), a lock body (6) is disposed.

7. A plant as claimed in claim 6, c h a r a c t e r i z e d i n that the lock body (6) is adapted to rotate, in order to allow continuous feeding of pellets out from the pellet chamber (3).

8. A plant as claimed in claim 5 or 6, c h a r a c t e r i z e d i n that to the pellet chamber (3) is assigned a first vacuum pump (4) adapted to keep the air pressure within the pellet chamber (3) at a first desired value lower than ambient pressure,

and that to the oil tank (8) is assigned a second vacuum pump (9 adapted to keep the air pressure within the oil tank (8) at a second desired value lower than ambient pressure, possibly also lower than said first value.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UTILITY/DESIGN PATENT
Docket No. **H82.2-10148**

# DECLARATION

As a below-named inventor, I(we) hereby declare that:

## TYPE OF DECLARATION

This declaration is of the following type:

- ☐ original
- ☐ design
- ☐ supplemental
- ☒ national stage of PCT
- ☐ divisional
- ☐ continuation
- ☐ continuation-in-part (CIP)

## INVENTORSHIP DECLARATION

My residence, post office address, and citizenship are as stated below next to my name;

I verily believe I am the original, first and sole inventor *(if only one name is listed below)* or an original, first and joint inventor *(if plural names are listed below)* of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**A METHOD OF MANUFACTURING FEED PELLETS AND PLANT FOR USE IN THE IMPLEMENTATION OF THE METHOD**

the specification of which:

a) ☐ is being filed concurrently herewith
b) ☒ was filed on 9-21-2001 and assigned Serial No. 09/937172
c) ☐ was filed as PCT International Application No. _____ filed on _____ and amended under PCT Article 19 on _____.

## ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations §1.56.

☐ In compliance with this duty there is attached an Information Disclosure Statement. 37 CFR 1.97.

## PRIORITY CLAIM

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d), of any foreign application(s) for patent or inventor's certificate or of any PCT international applications(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application for patent or inventor's certificate or any PCT international applications(s) designating at least one country other than the United States of America filed by me having the same subject matter having a filing date before that of the application on which priority is claimed.

| COUNTRY | APPLICATION NUMBER | DATE OF FILING (day, month, year) | PRIORITY CLAIMED UNDER 37 USC 119 |
|---|---|---|---|
| Norway | 19991447 | 3/25/1999 | ☒ YES ☐ NO |
| WO | PCT/NO00/00093 | 3/17/2000 | ☒ YES ☐ NO |
| | | | ☐ YES ☐ NO |
| | | | ☐ YES ☐ NO |

I hereby claim the benefit under Title 35 United States Code, §119(e) of any United States provisional application identified below.

| U.S. APPLICATIONS | |
|---|---|
| APPLICATION NUMBER | U.S. FILING DATE |
| 1. | |
| 2. | |

## CLAIM FOR BENEFIT OF EARLIER U.S./PCT APPLICATIONS(S) UNDER 35 U.S.C. §120

I hereby claim the benefit under Title 35, United States Code, §120 of any United States applications(s) or PCT international applications(s) designating the United States of America that is/are listed below.

| U.S. APPLICATIONS | |
|---|---|
| APPLICATION NUMBER | U.S. FILING DATE |
| 1. | |
| 2. | |
| PCT APPLICATIONS DESIGNATING THE U.S. | |
| PCT APPLICATION NO. | PCT FILING DATE |
| 3. | |

I hereby declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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